REMARKS

Claims 1-25, 27-35, 38-43, and 46-83 are before the Examiner. Claims 1, 2, 3, 27, 31, 46, 49, 58, 61, and 70-72 are amended to specify the polybutene oil has a molecular weight of at least 700, support for which is found inter alia in original claim 4. No new matter is presented and no new issues are raised in response to the Office Action.

The Advisory Action stats that only three carbon blacks are exemplified and it is not clear how these 3 carbon blacks can be commensurate in scope with the claimed invention. Applicants' claim 1 as currently amended recited a limitation of carbon black having a surface area of less than 30 m^2/g and D < 80 $cm^3/100g$. Applicants demonstrated N_2SA of 23 (Regal 90) and 7 (N-990) m^2/g. It is generally believed that the N_2SA of carbon blacks has a tolerance of ±3 (see Appendix 1, product specification of Regal 85). Therefore, applicants have demonstrated N_2SA at least in the range of 4-10 and 20-27. Applicants respectfully submit that the N_2SA demonstrated is commensurate in scope with the claimed invention, i.e., of less than 30 m^2/g. Applicants also demonstrated DBP of 32 and 42 corresponding to Regal 85 and N990. Applicants respectfully submit that the DBA demonstrated is commensurate in scope with the claimed invention, i.e., of less than 80 $cm^3/100g$.

The Advisory Action further indicates that the exemplified amount of carbon black are only as high as 120 phr. Applicants respectfully point out to the examiner that the combined carbon black in column 20 of Tables 9 and 10 is about 180 phr even though 60 phr of the carbon black is N660. The example data in the specification were developed using a design space approach that allows each variable to be mapped in developing a statistical "model" for the specific compositional system. The modeling approach is a standard tool in the art that allows interpolation and extrapolation to manipulate the input variables to approximate a set of blend/cured rubber properties that are desired for a particular application. Applicants will submit a § 1.132 declaration to explain the modeling approach should the examiner so desired.

The Advisory Action further indicates that only two polybutene oil are exemplified (Mn 1300 and 2350) which is not commensurate in scope with the claimed invention of Mn > 400. Applicants respectfully point to the amended claim where the limitation is Mn > 700.

Claims 1-25, 27-35, 38-43, and 46-83 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dias et al. (WO/ 02/48257 A2) (hereinafter Dias"). Applicant respectfully traverses.

In accordance with this invention it has been discovered that an isobutylene elastomeric composition comprising a measured amount of carbon black having a surface area of less than 30 m^2/g and a measured amount of polybutene oil obtains an elastomer composition of reduced air permeability, with the ability to maintain other rubber blend properties such as strength, flexibility, processability, etc.

Dias does not teach or suggest the criticality of using a low surface area black above the claimed critical threshold phr levels in combination with specified polybutene oil, nor does it teach or suggest applicant's unexpected results of improved (reduced) permeability while retaining the capability of tailoring the desired physical and processing characteristics required for an air barrier. The first/final Office Action urges that (A) applicants are required to but have not presented proper side-by-side examples, (B) the data are not commensurate with the scope of the invention, and (C) the unpreferred embodiments of Dias, even if not exemplified, must be considered in evaluating the obviousness of the claimed composition.

The Office Action faults applicant's showing for allegedly presenting comparative data only for carbon black in an amount of 60 phr. Applicant's independent claims are currently limited to "80 to 200 phr of carbon black having a surface area of less than 30 m^2/g and a dibutylphthalate oil absorption of less than 80 $cm^3/100$ gm."

It is respectfully submitted that side-by-side examples are not the only way to evidence nonobviousness of the claimed invention, and evidence of unexpected properties may be in the form of either a direct or an indirect comparison with the closest prior art which is commensurate in scope with the claims. See MPEP 716.02(b)III, citing examples of cases where indirect comparative testing was found sufficient to rebut a *prima facie* case of obviousness.

The nature of applicant's invention does not admit of a simple side-by-side comparison. There are multiple input variables, for example: amount and type of carbon black(s), amount and type of oil(s), surface area (N2SA) and DBP absorption values for the BLACK, MW of the polybutene oil. There are an even greater number of result variables, for example: Mooney scorch (indicative of time before the composition begins to cure and becomes too thick to process); Mooney viscosity (too high and the batch is too thick to process, too low and it is too soupy); hardness (too high results in brittleness, not desirable in tire innerliners/inner tubes); adhesion to NR (high value needed to bond to other tire components); and permeability (desirably low to retain inflation pressure). Furthermore, a wide variation in tires and tire components and applications means that no one set of ideal properties exists for a tire innerliner, which depends on the size of the vehicle/tire, tire manufacturer, etc.

The example data in the specification were developed using a design space approach that allows each variable to be mapped in developing a statistical "model" for the specific compositional system. The modeling approach is a standard tool in the art that allows interpolation and extrapolation to manipulate the input variables to approximate a set of blend/cured rubber properties that are desired for a particular application.

Compositions 1 and 2 explore the effect of N660 black when this is increased from 60 phr to 93.4 using naphthenic oil (CALSOL). See Table 5. It is noted that 60 phr N660/8 phr naphthenic oil is the standard reference composition used in the industry, see Composition I in Dias, for example, and it has the benchmark physical properties and processing characteristics suitable for an innerliner/inner tube, see claims 13, 14, 24, 38, 39, 40, 53, 54, 58-69, and 76. Increasing the N660 in Composition 2 in the specification reduced permeability somewhat, but unacceptably increased the Mooney viscosity and the Shore A Hardness, making the composition too thick for processing and too brittle for use as a tire innerliner. See Table 6. The two data points, however, provide some practical information than can be used to predict or estimate the effect of the N660 content in similar compositions. These data clearly show that increased N660 phr levels cannot be used as a practical matter to reduce permeability because it adversely affects

processability and physical properties needed for an innerliner to replace the Composition 1 material.

Compositions 3-7 in the specification explore the effects of varying the amount of Regal 90, a black with a lower N2SA relative to N660. See Tables 7 and 8. An increased amount of the lower N2SA black present generally increases Mooney viscosity, hardness, and modulus, but decreases strength, elongation and permeability. These data allow "mapping" of the effect of the phr of Regal 90 in similar compositions, and show that the use of a black similar to Regal 90 by itself (without polybutene oil) is unable to match the physical properties and processability in the Composition 3 reference baseline. For example, using sufficient Regal 90 for the desired Mooney viscosity (>120 phr) would undesirably increase hardness and modulus and make the strength and elongation too low.

Compositions 8-20 in Tables 9 and 10 provide data for statistical mapping of a 4-dimensional space by varying the amounts of (1) high N2SA black N660, (2) low N2SA black Regal 85, (3) naphthenic oil (CALSOL), and (4) polybutene oil (PARAPOL 1300). These 12 "data points" (8 and 9 are duplicates) with various different amounts of ingredients allow one to statistically predict or estimate the effect of manipulating the phr of each individual ingredient.

While the data for compositions 8-20 are useful for their predictive contributions to indicate the effect of varying the contents of the 4 components evaluated, none of the tested compositions entirely match all of the target physical properties of the baseline compositions 8-9. Using these data, however, it was possible for applicant and those skilled in the art to determine that a similar composition based on a combination of these 4 ingredients would have similar physical properties to compositions 8-9, when the N660 and naphthenic oil were at 0 phr, the Regal 85 was at 100 phr, and the PARAPOL 1300 was at 8 phr.

The value of the discovery was then demonstrated by evaluating compositions 21 and 22, see Tables 11 and 12. All of the physical properties and processing characteristics are nearly identical to Compositions 8 and 9, and yet the permeability is drastically reduced. This is not a chance result, and is not at all obvious from a fair reading of Dias. It is perhaps of interest to note that the total surface area of the carbon black (N2SA X phr) in the two different

compositions is approximately equivalent; 60 phr N660 X 34 m2/g = 2040 and 100 phr Regal 85 X 23 m2/g = 2300. The total surface area appears to roughly correlate with the desired physical/processing properties of the blend; however, it is only possible to achieve both the desired properties and reduced permeability by using a combination of the lower surface area black and the polybutene oil.

Thus, applicant demonstrates that the surface area of the black is a sufficiently predictive variable to support the phr levels claimed, as well as the N2SA ranges claimed (<30 m2/g in the independent claims; <25 m2/g in claims 2-4, e.g.). The data for compositions 23 – 26 (Tables 13-14) provide additional statistical information for the effects of a carbon black with an even lower surface area, clay and a higher molecular weight polybutene oil. Additional statistical data correlating the polybutene molecular weight with the physical/processing properties are seen in Dias, which has common inventors with this application and is cited in the specification at paragraph [00004] and incorporated by reference at [00111]. For example, the higher molecular weight polybutene oils generally slightly increase the Mooney viscosity relative to the lower MW polybutenes.

It is respectfully submitted that the statistical data presented by applicant meet or exceed any requirement for comparative testing. They show that carbon blacks with a surface area less than 30 m2/g and especially less than 25 m2/g will result in the ability to match physical properties with a lower permeability, and that polybutene oils of MW 700 and above can be utilized therewith to obtain heretofore unknown advantages. They show that the claims are statistically commensurate in scope. And they support the unmistakable conclusion that the embodiments of Dias, both preferred and unpreferred, did not enable or render obvious the subject matter claimed herein.

Having addressed all issues set out in the office action, Applicant respectfully submits that the pending claims are now in condition for allowance. Applicant invites the Examiner to telephone the undersigned attorney if there are any issues outstanding which have not been

addressed to the Examiner's satisfaction. The Commissioner is hereby authorized to charge counsel's Deposit Account No. 05-1712, for any fees, including extension of time fees or excess claim fees, required to make this response timely and acceptable to the Office.

Respectfully submitted,

January 24, 2007
Date

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Appendix 1.

CABOT WORLDWIDE

QUALITY CONTROL SPECIFICATIONS

GRADE: REGAL® 85
ISSUED: 1/09/97
REPLACES: 10/02/96
ISSUED BY: MJS
REVISION #: 2

Special Feature: ELSA Black for Tire Components

Test Method	Quality Test	Goal	Tolerance
	Particle Size		
25.13	Tinting Strength, % (ITRB IRB #3)	45	±4
23.0	ASTM Iodine Number, Mg/g	21	±4
23.3	CTAB, M^2/g	24	±3
23.6	Multipoint NSA M^2/g		
	Structure		
3.01	Relative Extrusion, % Weight of IRB#6	Record	
24.1	DBP Absorptometer, cc/100g	33	±3
24.2	CDBP, cc/100g	32	±3
34.0	Pour Density, #/ft³ (kg/m³) Wet Process Pellet	41	±3
34.0	Pour Density, #/ft³ (kg/m³) Dry Process Pellet		
	Non Carbon Constituents		
12.7	Toluene Discoloration, % T		70 min.
11.0	Ash, %		0.5 max.
43.15	325 Mesh Total Residue, ppm		
	325 Mesh Total Residue Metallic ppm		0 max.
35.53	PCS max./g		60 max.

COMPOUNDED RUBBER PROPERTIES

Test Method	Difference from IRB#6	ASTM-NR Loading 75 phr Time	Goal	Tolerance	ASTM-SBR Loading 80 phr Time	Goal	Tolerance
7.00	300% Mod.,psi (MPa)	30'	Record		50'	Record	
6.60	Pendulum Rebound	40'	Record				
7.00	Tensile Strength, psi (MPa)	30'	Record		50'	Record	
7.00	Ultimate Elongation, %	30'	Record		50'	Record	
3.60	Scorch, MS, minutes	@121°C			@135°C		
3.60	Mooney Viscosity, ML4				@100°C		

Reason for Revision: To correct 325 M and PCS.

Reference: MJS 1/97

Approval: